We claim:

1. On a sensory reproduction system having a processor with an instruction set including at least a computationally expensive floating point power function and a set of computationally less expensive floating point operations, a method of efficiently converting sensory data between a perceptual data representation and a physical data representation, where the perceptual data representation is related to the physical data representation by an expression involving a power function, the method comprising:

performing a plurality of the computationally less expensive floating point operations on an item of the sensory data;

combining results of the plural performed operations to yield an approximation of a result of the power function on the sensory data item; and

evaluating the expression using the approximation to provide a converted sensory data item.

2. The method of claim 1 wherein the computationally less expensive floating point operations are from a group comprising addition, subtraction, multiplication, square root, reciprocal square root, and reciprocal floating point operations.

3. The method of claim 1 wherein the combining results of the plural performed operations comprises performing a mathematical combination of the results, where the mathematical combination is from a group comprising arithmetic mean, harmonic mean, weighted sum and weighted difference.

4. The method of claim 1 wherein the combining results of the plural performed operations comprises performing a weighted mathematical combination of the results, where the weighted mathematical combination is from a group comprising a mean, sum and difference.

5. The method of claim 1 where the instruction set includes at least single instruction, multiple data floating point operation instructions, the method further comprising:

executing a single instruction, multiple data floating point operation instruction to perform a first of the computationally less expensive floating point operations on multiple items of the sensory data together.

6. An imaging system comprising:

a display monitor;

a display unit operative to display an image on the display monitor, where the image is represented by perceptual image data comprising a plurality of color pixel data specifying colors in a perceptual color space, the perceptual color space having a non-unity gamma;

a physical image processor operative to perform an image processing operation on physical image data in which color pixel data specifies colors in a physical color space, the physical color space having a unity gamma within a range; and

a perceptual/physical image converter operating to convert the perceptual image data to the physical image data according to a perceptual-to-physical conversion expression involving a power function so as to permit the physical image processor to perform the image processing operation prior to display, and to convert the physical image data back to the perceptual image data according to a physical-to-perceptual conversion expression involving an inverse power function after the image processing operation for display on the display monitor, the perceptual/physical image converter approximating the power function and the inverse power function as a weighted mathematical combination of plural computationally inexpensive floating point operations on items of the image data.

7. The imaging system of claim 6 wherein the perceptual/physical image converter operates to convert color values of the color pixel data within the range to have the unity gamma in the perceptual color space, while leaving color values of the color pixel data outside the range unaltered.

8. The imaging system of claim 6 wherein the perceptual/physical image converter operates to approximate the power function as a weighted mean of floating point operations taken from a group comprising addition, subtraction, multiplication, square root and reciprocal operations.

9. The imaging system of claim 6 wherein the perceptual/physical image converter operates to approximate the power function as a weighted summation of floating point operations taken from a group comprising addition, subtraction, multiplication, square root and reciprocal operations.

10. The imaging system of claim 6 wherein the computationally inexpensive floating point operations comprise at least some of addition, subtraction, multiplication, square root and reciprocal operations.

11. The imaging system of claim 10 wherein the perceptual color space has a gamma within a range of 1.7 to 2.5, and the perceptual/physical image converter approximates a computationally expensive power function with an exponent also in the range of 1.7 to 2.5 as a weighted mathematical combination of power functions in a similar range composed of addition, subtraction, multiplication, square root and reciprocal operations.

12. The imaging system of claim 10 wherein the perceptual color space has a gamma within a range of 1.7 to 2.5, and the perceptual/physical image converter approximates a computationally expensive inverse power function with an exponent in the range of $-1/1.7$ to $-1/2.5$ as a weighted mathematical combination of power functions composed of addition, subtraction, multiplication, square root and reciprocal operations.

13. The imaging system of claim 6 wherein the perceptual color space is the sRGB color space, and the perceptual/physical image converter approximates a power

function with exponent of 2.4 as a weighted harmonic mean of the power functions x^{-2} and $x^{-2.5}$ evaluated as the square of the reciprocal and the reciprocal square root, respectively.

14. The imaging system of claim 13 the perceptual/physical image converter approximates the power function with exponent of 2.4 by evaluating the expression,

$$x^{2.4} \approx \frac{1.285}{(0.285 + x^{-0.5})x^{-2}}.$$

15. The imaging system of claim 6 wherein the perceptual color space is the sRGB color space, and the perceptual/physical image converter approximates an inverse power function with exponent of –1/2.4 as a weighted arithmetic mean of the power functions $x^{0.5}$ and $x^{0.375}$.

16. The imaging system of claim 15 wherein the perceptual/physical image converter approximates the inverse power function with exponent of –1/2.4 by evaluating the expression, $x^{1/2.4} \approx w\sqrt{x} + (1-w)\frac{\sqrt{x}}{\sqrt{\sqrt{\sqrt{x}}}}$, where w is a weighting factor.

17. The imaging system of claim 15 wherein the perceptual/physical image converter approximates the inverse power function with exponent of –1/2.4 by evaluating the expressions, $y' = 0.78x^{0.5} + 0.22x^{0.25}$ and $x^{1/2.4} \approx \frac{1}{3}\left(2y' + \frac{2x^{1.25}}{y'^2}\right) - b$, where b is an offset.

18. The imaging system of claim 6 further comprising:

a computer processor having in instruction set including at least one single instruction, multiple data floating point operation instruction;

wherein the perceptual/physical image converter approximates the power function and the inverse power function by evaluating an expression combining exponential functions composed of at least one of square, square root and reciprocal operations performed using the at least one single instruction, multiple data floating point operation instruction.

19. A computer-readable data carrying medium having software program code carried thereon for effecting efficient conversion on a computer processor having a single instruction, multiple data floating point operation instruction set between sensory data represented in a non-linear scale sensory data model and representation in a linear scale sensory data model, where the non-linear and linear scale sensory data models are related by a conversion function involving a computationally expensive exponential power function, the software program code comprising:

first program code evaluating a first exponential function of plural items of the sensory data using single instruction, multiple data instructions for at least one of square, square root and reciprocal operations;

second program code evaluating a second exponential function of the plural items of the sensory data using single instruction, multiple data instructions for at least one of square, square root and reciprocal operations;

third program code combining the first and second exponential functions of the plural items to approximate the computationally expensive exponential power function of the plural items;

fourth program code evaluating the conversion function on the plural items using the approximation of the computationally expensive exponential power function of the plural items produced by the third program code to effect conversion of the plural items between the data models.

20. The computer-readable data carrying medium of claim 19 wherein the software program code converts image data represented in the sRGB color space to a physical color space, and wherein:

the first program code evaluates the function x^{-2} of the plural items using single instruction, multiple data instructions for the square of the reciprocal of the plural items;

the second program code evaluates the function $x^{-0.5}$ of the plural items using single instruction, multiple data instructions for the reciprocal square root of the items; and

the third program code evaluates a weighted harmonic mean using the functions evaluated by the first and second program code.

21. The computer-readable data carrying medium of claim 19 wherein the third program code evaluates the expression, $x^{2.4} \approx \dfrac{1.285}{(0.285 + x^{-0.5})x^{-2}}$.

22. The computer-readable data carrying medium of claim 19 wherein the software program code converts image data from a physical color space to the sRGB color space, and wherein:

the first program code evaluates the function $x^{0.5}$ of the plural items using single instruction, multiple data instructions for the square root of the plural items;

the second program code evaluates the function $x^{0.375}$ of the plural items using single instruction, multiple data instructions for three successive square roots of the plural items; and

the third program code evaluates a weighted mean of the functions evaluated by the first and second program code.

23. The computer-readable data carrying medium of claim 19 wherein the software program code converts image data from a physical color space to the sRGB color space, and wherein:

the first program code evaluates the function $x^{0.5}$ of the plural items using single instruction, multiple data instructions for the square root of the plural items;

the second program code evaluates the function $x^{0.25}$ of the plural items using single instruction, multiple data instructions for the fourth root of the plural items;

the third program code computes an approximation of the function $x^{1/2.4}$ by using single instruction, multiple data instructions to evaluate a weighted mean of the functions evaluated by the first and second program code, and refines the approximation by performing a Newton-Raphson iteration of the cube root of the function $x^{1.25}$ using the evaluated weighted mean as an initial estimate.